

1. A synthetic peptide comprising an amino acid sequence derived from the HR1 region of HIV-1 gp41; wherein the HR1 region consists of native amino acid sequence shown as SEQ ID NO:1 or polymorphisms thereof; wherein the HR1 region from which the synthetic peptide is derived comprises a hydrophobic domain of amino acids corresponding to amino acid residues in positions 28 to 36 of SEQ ID NO:1 or polymorphisms thereof; wherein the amino acid residues comprising the hydrophobic domain correspond to heptad repeat positions "efgabcdef"; and wherein the amino acid sequence of the synthetic peptide further comprises one or more amino acid substitutions in the heptad repeat positions "efgabcdef" comprising the hydrophobic domain, as compared to the native amino acid sequence of the HR1 region, which enables synthetic peptide to self-assemble in solution into trimers.
2. The synthetic peptide according to claim 1, wherein the one or more amino acid substitutions in the hydrophobic domain comprise either a substitution in the "c" position, or a substitution in both the "g" position and the "c" position, of the heptad repeat positions "efgabcdef".
3. The synthetic peptide according to claim 2, wherein the synthetic peptide comprises an amino acid substitution additional to a substitution in either the "c" position or both the "g" position and "c" position, wherein the additional amino acid substitution is in one or more amino acid positions of one or more heptads of the synthetic peptide, and wherein the one or more amino acid positions is selected from the group consisting of an "a" position, a "d" position, a "b" position, and a combination thereof.
4. The synthetic peptide according to claim 1, wherein the one or more amino acid substitutions in the hydrophobic domain comprising the heptad repeat positions "efgabcdef" are in a position of the heptad repeat positions selected from the group consisting of a C-terminal "e" position, a C-terminal "f" position, and a combination thereof.
5. The synthetic peptide according to claim 4, wherein the synthetic peptide comprises an amino acid substitution additional to the substitution in one or more of the "e" position and the "f" position, wherein the additional amino acid substitution is in one or more amino acid positions of one or more heptads of the synthetic peptide, and

wherein the one or more amino acid positions is selected from the group consisting of the "a" position, a "d" position, a "b" position, and a combination thereof.

6. The synthetic peptide according to claim 1, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of the synthetic peptide, and a combination thereof.

7. The synthetic peptide according to claim 2, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of the synthetic peptide, and a combination thereof.

8. The synthetic peptide according to claim 3, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of the synthetic peptide, and a combination thereof.

9. The synthetic peptide according to claim 4, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of the synthetic peptide, and a combination thereof.

10. The synthetic peptide according to claim 5, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid

substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of the synthetic peptide, and a combination thereof.

11. A trimer formed from synthetic peptide according to claim 1.

12. The trimer according to claim 11, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of synthetic peptide forming the trimer, and a combination thereof.

13. A trimer formed from synthetic peptide according to claim 2.

14. The trimer according to claim 13, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of synthetic peptide forming the trimer, and a combination thereof.

15. A trimer formed from synthetic peptide according to claim 3.

16. The trimer according to claim 15, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of synthetic peptide forming the trimer, and a combination thereof.

17. A trimer formed from synthetic peptide according to claim 4.

18. The trimer according to claim 17, further comprising a component selected from

the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of synthetic peptide forming the trimer, and a combination thereof.

19. A trimer formed from synthetic peptide according to claim 5.

20. The trimer according to claim 19, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of synthetic peptide forming the trimer, and a combination thereof.

21. A synthetic peptide comprising an amino acid sequence derived from the HR1 region of HIV-1 gp41; wherein the amino acid sequence comprises a heptad repeat containing a plurality of heptads, and a hydrophobic domain comprising heptad repeat positions "efgabcdef" corresponding to amino acids 28 to 36 of SEQ ID NO:1 or polymorphisms thereof; wherein the synthetic peptide comprises an amino acid substitution in either the "c" position of the hydrophobic domain, or in both the "g" position and the "c" position of the hydrophobic domain, as compared to native sequence of the HR1 region; wherein the amino acid substitution enables the synthetic peptide to self-associate in solution into trimers.

22. The synthetic peptide according to claim 21, wherein the synthetic peptide comprises an amino acid substitution, as compared to native sequence of the HR1 region, additional to a substitution in a "c" position or in both the "g" position and "c" position; wherein the additional amino acid substitution is in one or more heptads of the synthetic peptide; and wherein the additional amino acid substitution is in one or more amino acid positions selected from the group consisting of an "a" position, a "d" position, a "b" position, and a combination thereof.

23. The synthetic peptide according to claim 21, further comprising a component

selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of the synthetic peptide, and a combination thereof.

24. The synthetic peptide according to claim 22, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of the synthetic peptide, and a combination thereof.

25. A trimer formed from synthetic peptide according to claim 21.

26. The trimer according to claim 25, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of synthetic peptide forming the trimer, and a combination thereof.

27. A trimer formed from synthetic peptide according to claim 22.

28. The trimer according to claim 27, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of synthetic peptide forming the trimer, and a combination thereof.

29. A synthetic peptide comprising an amino acid sequence derived from the HR1 region of HIV-1 gp41; wherein the amino acid sequence comprises a heptad repeat containing a plurality of heptads, and a hydrophobic domain comprising heptad repeat

positions "efgabcdef" corresponding to amino acids 28 to 36 of SEQ ID NO:1 or polymorphisms thereof; wherein the synthetic peptide comprises an amino acid substitution in one or more of an "e" position at the C-terminus of the hydrophobic domain, an "f" position at the C-terminus of the hydrophobic domain, or a combination thereof, as compared to native sequence of the HR1 region; and wherein the amino acid substitution enables the synthetic peptide to self-associate in solution into trimers.

30. The synthetic peptide according to claim 29, wherein the synthetic peptide comprises an amino acid substitution, as compared to native sequence of the HR1 region, additional to the substitution in one or more of an "e" position and "f" position; wherein the additional amino acid substitution is in one or more heptads of the synthetic peptide; and wherein the additional amino acid substitution is in one or more amino acid positions selected from the group consisting of an "a" position, a "d" position, a "b" position, and a combination thereof.

31. The synthetic peptide according to claim 29, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of the synthetic peptide, and a combination thereof.

32. The synthetic peptide according to claim 30, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of the synthetic peptide, and a combination thereof.

33. A trimer formed from synthetic peptide according to claim 29.

34. The trimer according to claim 33, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an

addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of synthetic peptide forming the trimer, and a combination thereof.

35. A trimer formed from synthetic peptide according to claim 30.

36. The trimer according to claim 35, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of synthetic peptide forming the trimer, and a combination thereof.

37. A synthetic peptide comprising an amino acid sequence selected from the group of amino acid sequences consisting of: SEQ ID NO:29, SEQ ID NO:30, SEQ ID NO:31, SEQ ID NO:32, SEQ ID NO:34, SEQ ID NO:35, SEQ ID NO:36, SEQ ID NO:37, SEQ ID NO:38, SEQ ID NO:39, SEQ ID NO:40, SEQ ID NO:43, SEQ ID NO:81, and SEQ ID NO:82.

38. The synthetic peptide according to claim 37, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of the synthetic peptide, and a combination thereof.

39. A trimer formed from synthetic peptide according to claim 37.

40. The trimer according to claim 39, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of synthetic peptide forming the trimer, and a combination thereof.

41. A trimer formed from self-association of synthetic peptide in solution, wherein the synthetic peptide comprises an amino acid sequence derived from the HR1 region of HIV-1 gp41; wherein the HR1 region consists of native amino acid sequence shown as SEQ ID NO:1 or polymorphisms thereof; wherein the HR1 region from which the synthetic peptide is derived comprises a hydrophobic domain of amino acids corresponding to amino acid residues 28 to 36 of SEQ ID NO:1 or polymorphisms thereof; wherein the amino acid residues comprising the hydrophobic domain correspond to heptad repeat positions "efgabcdef"; and wherein the amino acid sequence of the synthetic peptide further comprises one or more amino acid substitutions in the heptad repeat positions "efgabcdef" comprising the hydrophobic domain, as compared to native amino acid sequence of the HR1 region, which enables synthetic peptide to self-associate in solution into trimers.

42. The trimer according to claim 39, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of synthetic peptide forming the trimer, and a combination thereof.

43. A trimer formed from self-association of synthetic peptide in solution, wherein the synthetic peptide comprises an amino acid sequence derived from the HR1 region of HIV-1 gp41; wherein the amino acid sequence comprises a heptad repeat containing a plurality of heptads, and a hydrophobic domain comprising heptad repeat positions "efgabcdef" corresponding to amino acids 28 to 36 of SEQ ID NO:1 or polymorphisms thereof; wherein the synthetic peptide comprises an amino acid substitution in either the "c" position of the hydrophobic domain, or in both the "g" position and the "c" position of the hydrophobic domain, as compared to native sequence of the HR1 region; and wherein the amino acid substitution enables the synthetic peptide to self-associate in solution into trimers.

44. The trimer according to claim 43, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically



acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of synthetic peptide forming the trimer, and a combination thereof.

45. A trimer formed from self-association of synthetic peptide in solution, wherein the synthetic peptide comprises an amino acid sequence derived from the HR1 region of HIV-1 gp41; wherein the amino acid sequence comprises a heptad repeat containing a plurality of heptads, and a hydrophobic domain comprising heptad repeat positions "efgabcdef" corresponding to amino acids 28 to 36 of SEQ ID NO:1 or polymorphisms thereof; wherein the synthetic peptide comprises an amino acid substitution in either the "c" position of the hydrophobic domain or in both the "g" position and the "c" position of the hydrophobic domain, as compared to native sequence of the HR1 region; wherein the synthetic peptide also comprises an amino acid substitution, additional to the substitution in the "c" position or in both the "g" position and "c" position, in one or more heptads of the synthetic peptide; wherein the additional amino acid substitution is in one or more amino acid positions selected from the group consisting of an "a" position, a "d" position, a "b" position, and a combination thereof; and wherein the amino acid substitutions enable the synthetic peptide to self-associate in solution into trimers.

46. The trimer according to claim 45, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of synthetic peptide forming the trimer, and a combination thereof.

47. A trimer formed from self-association of synthetic peptide in solution, wherein the synthetic peptide comprises an amino acid sequence derived from the HR1 region of HIV-1 gp41; wherein the amino acid sequence comprises a heptad repeat containing a plurality of heptads, and a hydrophobic domain comprising heptad repeat positions "efgabcdef" corresponding to amino acids 28 to 36 of SEQ ID NO:1 or polymorphisms thereof; wherein the synthetic peptide comprises an amino acid substitution in one or more of an "e" position at the C-terminus of the hydrophobic domain, an "f" position at

the C-terminus of the hydrophobic domain, or a combination thereof, as compared to native sequence of the HR1 region; and wherein the amino acid substitution enables the synthetic peptide to self-associate in solution into trimers.

48. The trimer according to claim 47, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of synthetic peptide forming the trimer, and a combination thereof.

49. A trimer formed from self-association of synthetic peptide in solution, wherein the synthetic peptide comprises an amino acid sequence derived from the HR1 region of HIV-1 gp41; wherein the amino acid sequence comprises a heptad repeat containing a plurality of heptads, and a hydrophobic domain comprising heptad repeat positions "efgabcdef" corresponding to amino acids 28 to 36 of SEQ ID NO:1 or polymorphisms thereof; wherein the synthetic peptide comprises an amino acid substitution in one or more of an "e" position at the C-terminus of the hydrophobic domain, an "f" position at the C-terminus of the hydrophobic domain, or a combination thereof, as compared to the native sequence of the HR1 region; wherein the synthetic peptide also comprises an amino acid substitution, additional to the substitution in either or both of the "e" position and the "f" position, in one or more heptads of the synthetic peptide; wherein the additional amino acid substitution is in one or more amino acid positions selected from the group consisting of an "a" position, a "d" position, a "b" position, and a combination thereof; and wherein the amino acid substitutions enable the synthetic peptide to self-associate in solution into trimers.

50. The trimer according to claim 49, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of synthetic peptide forming the trimer, and a combination thereof.

51. A trimer formed from self association of synthetic peptide in solution, wherein the synthetic peptide comprises an amino acid sequence selected from the group of amino acid sequences consisting of: SEQ ID NO:29, SEQ ID NO:30, SEQ ID NO:31, SEQ ID NO:32, SEQ ID NO:34, SEQ ID NO:35, SEQ ID NO:36, SEQ ID NO:37, SEQ ID NO:38, SEQ ID NO:39, SEQ ID NO:40, SEQ ID NO:43, SEQ ID NO:81, and SEQ ID NO:82.

52. The trimer according to claim 49, further comprising a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of synthetic peptide forming the trimer, and a combination thereof.

53. A method for inhibition of transmission of HIV-1 to a cell comprising contacting the virus, in the presence of a target cell, with synthetic peptide in a concentration effective to inhibit infection of the cell by HIV-1, thereby inhibiting transmission of HIV-1 to the cell, wherein:

the synthetic peptide comprises an amino acid sequence derived from the HR1 region of HIV-1 gp41;

the HR1 region consists of native amino acid sequence shown as SEQ ID NO:1 or polymorphisms thereof;

the HR1 region from which the synthetic peptide is derived comprises a hydrophobic domain of amino acids comprising the sequence corresponding to amino acid residues 28 to 36 of SEQ ID NO:1 or polymorphisms thereof;

amino acid residues comprising the hydrophobic domain correspond to heptad repeat positions "efgabcdef"; and

the amino acid sequence of the synthetic peptide comprises one or more amino acid substitutions in the heptad repeat positions "efgabcdef" comprising the hydrophobic domain, as compared to the native amino acid sequence of the HR1 region, which enables synthetic peptide to self-assemble in solution into trimers.

54. The method according to claim 53, wherein the one or more amino acid substitutions in the hydrophobic domain comprise a substitution in either the "c" position or in both the "g" position and the "c" position of the heptad repeat positions "efgabcdef".

55. The method according to claim 54, wherein the synthetic peptide comprises an amino acid substitution additional to the substitution in either the "c" position or in both the "g" position and "c" position, wherein the additional amino acid substitution is in one or more amino acid positions of one or more heptads of the synthetic peptide, and wherein the one or more amino acid positions is selected from the group consisting of an "a" position, a "d" position, a "b" position, and a combination thereof.

56. The method according to claim 53, wherein the one or more amino acid substitutions in the hydrophobic domain comprising the heptad repeat positions "efgabcdef" are selected from the group consisting of a C-terminal "e" position, a C-terminal "f" position, and a combination thereof.

57. The method according to claim 56, wherein the synthetic peptide comprises an amino acid substitution additional to the substitution in one or more of the "e" position and the "f" position, wherein the additional amino acid substitution is in one or more amino acid positions of one or more heptads of the synthetic peptide, and wherein the one or more amino acid positions is selected from the group consisting of an "a" position, a "d" position, a "b" position, and a combination thereof.

58. The method according to claim 53, wherein synthetic peptide further comprises a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of the synthetic peptide, and a combination thereof.

59. The method according to claim 53, wherein synthetic peptide is in an oligomeric form comprising trimers.

60. The method according to claim 59, wherein the trimers further comprise a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than

twenty amino acids to either or both of the amino terminus or carboxy terminus of synthetic peptide forming the trimers, and a combination thereof.

61. The method of claim 53, wherein the synthetic peptide is parenterally administered to an individual.

62. A method for inhibition of transmission of HIV-1 to a target cell comprising adding synthetic peptide to the virus and a target cell in an amount effective to inhibit infection of the cell by HIV-1, wherein:

- the synthetic peptide comprises an amino acid sequence derived from the HR1 region of HIV-1 gp41;

- the HR1 region consists of native amino acid sequence shown as SEQ ID NO:1 or polymorphisms thereof;

- the HR1 region from which the synthetic peptide is derived comprises a hydrophobic domain of amino acids comprising the sequence corresponding to amino acid residues 28 to 36 of SEQ ID NO:1 or polymorphisms thereof;

- amino acid residues comprising the hydrophobic domain correspond to heptad repeat positions "efgabcdef"; and

- the amino acid sequence of the synthetic peptide comprises one or more amino acid substitutions in the heptad repeat positions "efgabcdef" comprising the hydrophobic domain, as compared to the native amino acid sequence of the HR1 region, which enables synthetic peptide to self-assemble in solution into trimers.

63. The method according to claim 62, wherein the one or more amino acid substitutions in the hydrophobic domain comprise a substitution in either the "c" position, or in both the "g" position and the "c" position, of the heptad repeat positions "efgabcdef".

64. The method according to claim 63, wherein the synthetic peptide comprises an amino acid substitution additional to a substitution in either the "c" position or both the "g" position and "c" position, wherein the additional amino acid substitution is in one or more amino acid positions of one or more heptads of the synthetic peptide, and wherein the one or more amino acid positions is selected from the group consisting of an "a" position, a "d" position, a "b" position, and a combination thereof.

65. The method according to claim 62, wherein the one or more amino acid substitutions in the hydrophobic domain comprising the heptad repeat positions "efgabcdef" are selected from the group consisting of a C-terminal "e" position, a C-terminal "f" position, and a combination thereof.
66. The method according to claim 65, wherein the synthetic peptide comprises an amino acid substitution additional to the substitution in one or more of the "e" position and the "f" position, wherein the additional amino acid substitution is in one or more amino acid positions of one or more heptads of the synthetic peptide, and wherein the one or more amino acid positions is selected from the group consisting of an "a" position, a "d" position, a "b" position, and a combination thereof.
67. The method according to claim 62, wherein synthetic peptide further comprises a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of the synthetic peptide, and a combination thereof.
68. The method according to claim 62, wherein synthetic peptide is in an oligomeric form comprising trimers.
69. The method according to claim 68, wherein the trimers further comprise a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of synthetic peptide forming the trimers, and a combination thereof.
70. The method of claim 62, wherein synthetic peptide is parenterally administered to an individual.
71. A method for inhibiting HIV fusion with a target cell comprising contacting the virus, in the presence of a target cell, with synthetic peptide in a concentration effective

to inhibit membrane fusion between the virus and the cell, wherein:

the synthetic peptide comprises an amino acid sequence derived from the HR1 region of HIV-1 gp41;

the HR1 region consists of native amino acid sequence shown as SEQ ID NO:1 or polymorphisms thereof;

the HR1 region from which the synthetic peptide is derived comprises a hydrophobic domain of amino acids comprising the sequence corresponding to amino acid residues 28 to 36 of SEQ ID NO:1 or polymorphisms thereof;

amino acid residues comprising the hydrophobic domain correspond to heptad repeat positions "efgabcdef"; and

the amino acid sequence of the synthetic peptide comprises one or more amino acid substitutions in the heptad repeat positions "efgabcdef" comprising the hydrophobic domain, as compared to the native amino acid sequence of the HR1 region, which enables synthetic peptide to self-assemble in solution into trimers.

72. The method according to claim 71, wherein the one or more amino acid substitutions in the hydrophobic domain comprise a substitution in either the "c" position or in both the "g" position and the "c" position of the heptad repeat positions "efgabcdef".

73. The method according to claim 72, wherein the synthetic peptide comprises an amino acid substitution additional to the substitution in the "c" position or in both the "g" position and "c" position, wherein the additional amino acid substitution is in one or more amino acid positions of one or more heptads of the synthetic peptide, and wherein the one or more amino acid positions is selected from the group consisting of the "a" position, a "d" position, a "b" position, and a combination thereof.

74. The method according to claim 71, wherein the one or more amino acid substitutions in the hydrophobic domain comprising the heptad repeat positions "efgabcdef" are selected from the group consisting of a C-terminal "e" position, a C-terminal "f" position, and a combination thereof.

75. The method according to claim 74, wherein the synthetic peptide comprises an amino acid substitution additional to the substitution in one or more of the "e" position and the "f" position, wherein the additional amino acid substitution is in one or more

amino acid positions of one or more heptads of the synthetic peptide, and wherein the one or more amino acid positions is selected from the group consisting of an "a" position, a "d" position, a "b" position, and a combination thereof.

76. The method according to claim 71, wherein synthetic peptide further comprises a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of the synthetic peptide, and a combination thereof.

77. The method according to claim 71, wherein synthetic peptide is in an oligomeric form comprising trimers.

78. The method according to claim 77, wherein the trimers further comprise a component selected from the group consisting of one or more reactive functionalities, a pharmaceutically acceptable carrier, a macromolecular carrier, an amino acid substitution comprising an addition of no less than one amino acid and no more than twenty amino acids to either or both of the amino terminus or carboxy terminus of synthetic peptide forming the trimers, and a combination thereof.

79. The method of claim 71, wherein synthetic peptide is parenterally administered to an individual.